EXECUTIVE SUMMARY

This first volume of the Accreditation Support Package (ASP-I) is designed to provide a potential user with a characterization of the current status of THUNDER 6.5 with respect to criteria related to its general acceptability for use. The information presented in this volume should characterize the model well enough to provide an initial determination of its suitability for a particular application. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications. The information provided to characterize the subject model consists of the following elements.

a. A description of the configuration management baseline for the model, including version history, current version status, model development policy (including beta site provisions), documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model;

b. A summary of implicit and explicit assumptions and limitations inherent in the model because of its design and/or coding assumptions or structure, as well as any implied constraints to the use of the model that are a consequence of these assumptions or structures. A listing of known errors or anomalies found as a result of prior verification and validation (V&V) efforts is also included;

c. A review of the model's development, V&V and usage histories, as well as a summary of prior accreditations;

d. A review of the status of model documentation and its conformity to accepted software documentation standards, as well a review of documentation with respect to verification requirements, and;

e. A summary of overall software quality as characterized by conformance to accepted design and coding practices.

ASP-I provides the details of these information elements in a single document. The degree to which each information element is complete and current provides a general indication of whether the model is suitable for further consideration for use in a particular application.

Configuration Management (CM) Baseline: THUNDER is a stochastic, two-sided, campaign-level simulation of air, land, and naval warfare. It integrates the planning and execution of air and ground combat and support operations and provides a traceable "thread" from individual system to campaign impact. The simulation can be run in two modes: analytical and wargame. The analytical mode supports traditional studies examining issues related to the contribution of systems, capabilities, forces, and employment concepts in the context of theater-level operational outcomes. The wargame mode supports the near-real time intervention of participants in seminar-type gaming activities, accommodating side and player moves to dynamically influence the outcome of the run.

The current baseline version is 6.5 which was released in October 1997. THUNDER is managed by the Air Force Studies and Analyses Agency (AFSAA), and software support

is currently provided by System Simulation Solutions, Inc (S3I). The software development environment and configuration management processes associated with THUNDER are well-established and well-documented and provide model stability and consistency. The source code is written in a general-purpose language (SIMSCRIPT II.5™) with features specifically designed to support complex simulations. THUNDER is administered under a configuration management plan that provides formal approaches to addressing change requirements, establishes a disciplined software development environment and authorizes well-defined version control procedures. In addition to the core model, the formal configuration items include a support Toolkit consisting of numerous post-processing tools and UNIX scripts, a comprehensive documentation set, and unclassified, sample databases.

Assumptions, Limitations, and Errors: Lists of assumptions, limitations, and errors for THUNDER 6.5 are presented in Tables 3-1, 3-2, and 3-3 of Section 3. The assumptions and limitations associated with THUNDER reflect the objective, design, and intended uses of the simulation. The errors associated with version 6.5 imply minimal analytical risk for applications that can accommodate the simulation's assumptions and limitations. Model corrections and enhancements are being made continually in accordance with the formal CM plan, and planned enhancements for version 6.6 (listed in Appendix C) address some of the limitations and errors in version 6.5.

V&V Status and Usage History: Very little verification or validation documentation is available for THUNDER. THUNDER was developed prior to the establishment of DoD requirements for software design documentation which are necessary for formal verification, and this documentation does not exist. In spite of this, the model developer does conduct informal software verification during the development process and many users have conducted logical verification, which involves an evaluation of algorithms and code by subject matter experts.

As a campaign-level simulation of military operations, THUNDER is in a category of M&S for which model level output validation options are limited at best. The general consensus within the VV&A community is that the complexity of the known/addressed factors (the numbers and types of objects, processes and actions) and the extent of the unknown/unaddressed factors (behaviors, effects and interactions), when combined with lack of relevant field data, make output validation extremely difficult (if not impossible in the theoretical sense). In practical terms, output validation for campaign-level simulations generally involve evaluation of the results by subject matter experts to determine the extent to which they match expected outcomes.

Since its initial development in 1983, THUNDER has been employed in numerous studies by many different organizations. Its wide-spread use is strong evidence of community acceptance. The THUNDER user base spans the policy, acquisition, and operational domains and includes the Joint community, the individual services, Federally Funded Research and Development Centers, and defense contractors in both the US and several allied nations. Users may join the THUNDER User Group (TUG) which is sponsored by the AFSAA and user membership fees. TUG meetings are held annually and provide an opportunity for users to interact with THUNDER developers and fellow users.

Documentation Assessment: A documentation assessment is normally part of ASP-I; however, this assessment was outside the scope of the task order under which this edition was prepared.

Software Quality Assessment: A software quality assessment is normally part of ASP-I; however, this assessment was outside the scope of the task order under which this edition was prepared.